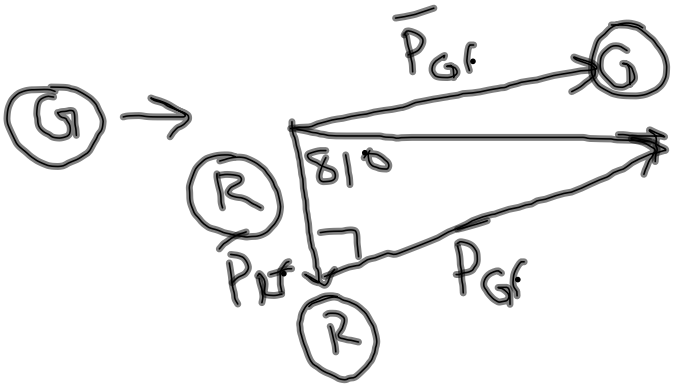
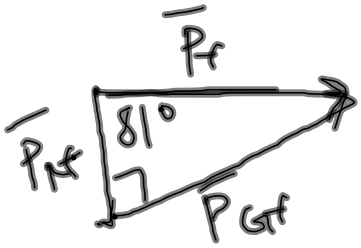
HW 5 #1:



$$\bar{P}_f = \bar{P}_i = \bar{P}_{Gi} + \cancel{\bar{P}_{Ri}}^{\,0}$$

$$= m_G \bar{V}_{Gi}$$

$$= 270 \text{ kg-m/s}$$



$$P_{Rf} = P_f \cos(81°) \qquad P_{Gf} = P_f \sin(81°)$$

$$= 42.24 \text{ kg-m/s} \qquad = 266.7 \text{ kg-m/s}$$

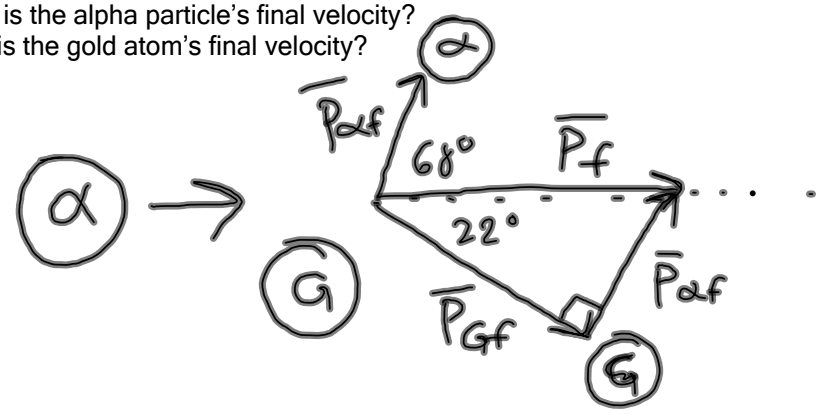
$$V_{Rf} = \frac{P_{Rf}}{m_R} = 2.11 \text{ m/s} \qquad V_{Gf} = 17.8 \text{ m/s}$$

#2:

An alpha particle (mass = 6.64 E -27 kg) moving 1.50 E 7 m/s hits a gold atom (mass = 3.27 E -25 kg). After they hit, the gold atom is moving to the right at a 22 degree angle from the alpha particle's original direction. The alpha particle is now moving at a 68 degree angle to the left of its original direction.

a. What is the alpha particle's final velocity?

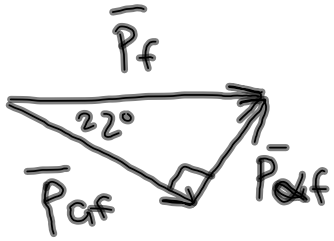
b.What is the gold atom's final velocity?



$$\bar{P}_f = \bar{P}_i$$

$$= \bar{P}_{\alpha i} + \cancel{\bar{P}_{Gi}}^{\,0}$$

$$= m_\alpha \bar{V}_{\alpha i} = 9.96E-20 \text{ kg·m/s}$$

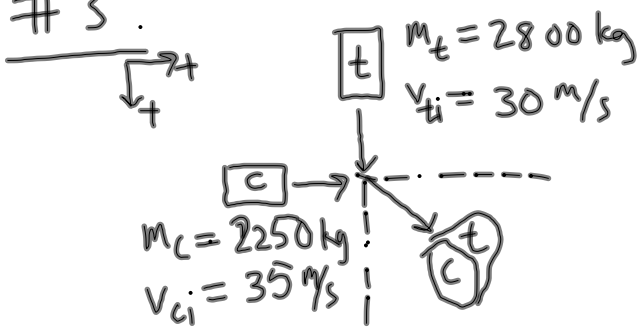


$P_{Gf} = P_f \cos(22°)$ $\quad$ $P_{\alpha f} = P_f \sin(22°)$

$= 9.23E-20$ kg·m/s $\quad$ $= 3.73E-20$ kg·m/s

$V_{Gf} = \frac{P_{Gf}}{m_G} = 2.82E5$ m/s $\quad$ $V_{\alpha f} = 5.7E6$ m/s

#3:

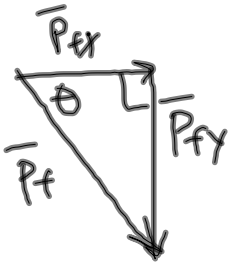


X-direction:

$$\bar{P}_{fx} = \bar{P}_{ix} = \bar{P}_{cix} + \bar{P}_{tix}$$
$$= m_c \bar{v}_{cix}$$
$$= 78750 \text{ kg-m/s}$$

y-direction:

$$\bar{P}_{fy} = \bar{P}_{iy} = \bar{P}_{ciy} + \bar{P}_{tiy}$$
$$= m_t \bar{v}_{tiy}$$
$$= 84000 \text{ kg m/s}$$

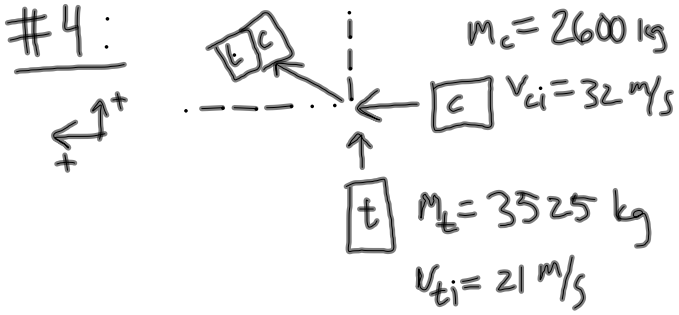


$$\theta = \tan^{-1}\left(\frac{P_{fy}}{P_{fx}}\right)$$
$$= 46.8°$$

$$P_f^2 = P_{fx}^2 + P_{fy}^2$$
$$P_f = 115141 \text{ kg-m/s} \quad S \text{ of } E$$

$$P_f = (m_c + m_t) v_f$$
$$v_f = 22.8 \text{ m/s}$$
$$\bar{v}_f = 22.8 \text{ m/s} \text{ @ } 46.8° \text{ S of E}$$

#4:

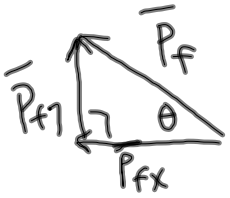


X- direction

$$\bar{P}_{fx} = \bar{P}_{ix} = \bar{P}_{cix} + \bar{P}_{tix}$$
$$= m_c \bar{v}_{cix}$$
$$= 83200 \text{ kg-m/s}$$

y- direction

$$\bar{P}_{fy} = \bar{P}_{iy} = \bar{P}_{ciy} + \bar{P}_{tiy}$$
$$= m_t \bar{v}_{tiy}$$
$$= 74025 \text{ kg-m/s}$$



$$\theta = \tan^{-1}\left(\frac{P_{fy}}{P_{fx}}\right)$$

$P_f^2 = P_{fx}^2 + P_{fy}^2$ = 41.7° N of W

$P_f = 111364$ kg-m/s

$$v_f = \frac{P_f}{(m_c + m_t)} = 18.2 \text{ m/s}$$

$\bar{v}_f = 18.2$ m/s @ 41.7° N of W